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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/508,970	11/15/2004	Peter Jan Nieuwenhuizen	13877/13601	7577
26646	7590	11/01/2007		
KENYON & KENYON LLP ONE BROADWAY NEW YORK, NY 10004			EXAMINER DOE, SHANTA G	
			ART UNIT 1797	PAPER NUMBER
			MAIL DATE 11/01/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/508,970	<b>Applicant(s)</b> NIEUWENHUIZEN ET AL.	
	<b>Examiner</b> Shanta G. Doe	<b>Art Unit</b> 1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 15 November 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5,7 and 9-17 is/are rejected.
- 7) ☒ Claim(s) 6 and 8 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 September 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>2/22/2005 and 7/21/2005</u> . | 6) <input type="checkbox"/> Other: _____  |

**DETAILED ACTION**

***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 11, 14 and 15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 11, the claim recites the limitations "the agent" and "the sulfur oxide". There is insufficient antecedent basis for the above limitations in the claim. The examiner interpreting claims 11 to depend on claim 4 instead of claim 1 because there is proper antecedent basis for the above limitations in claim 4.

Regarding claim 15, the claim recites the limitation "the method of claim 1 wherein the ultra-filtration membrane". There is insufficient antecedent basis for this limitation in the claim. The examiner interpreting claims 15 to depend on claim 3 instead of claim 1 because there is proper antecedent basis for the above limitation in claim 3.

Regarding claim 14, the word "preferably" renders the claim indefinite because it is unclear whether the limitation(s) following the word are part of the claimed invention.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1- 5, 7, 10-12 and 14-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Verbraak (WO00/02646) in view of Buisman et al (US 5,891,408) and Grierson (WO 92/17401).

Regarding claim 1, Verbraak discloses a method for removing a nitrogen oxide (NO<sub>x</sub>) from a gas by bringing the gas into contact with a scrub liquid in a scrubber (1) for

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converting the nitrogen oxide into molecular nitrogen (N<sub>2</sub>), wherein the scrub liquid is provided with agents (such as EDTA) for removing nitrogen oxide from the gas and biomass used in the form of free cells can be circulated with the scrubbing liquid in the scrubber, after which at least a portion of the scrub liquid is subjected to a membrane separation process for separating at least part of the metal ion chelate, and other solidified components, from dissolved components and recycling the chelate containing portion of the scrub liquid to the scrubber (see Verbraak page 2 line 30 –39 page 3 line 1, lines 7 –16page 5 lines 33 –39 , page 7 lines 10 –16) . However, Verbraak fails to specifically disclose a membrane separation process comprising the following steps: (a) filtering at least a portion of the scrub liquid using a first membrane capable of permeating the metal ion chelate to provide a first retentate liquid comprising the biomass and other solidified components, and a first permeate liquid comprising at least part of the metal ion chelate and dissolved components, and

(b) nanofiltering the first permeate liquid to give a second retentate liquid comprising the metal ion chelate and a second permeate liquid comprising dissolved components, and

(c) recycling at least part of the second retentate liquid to the scrubber

Buisman et al (US 5,891,408) discloses a method of purifying a gas containing nitrogen oxides in which the gas is scrubbed with circulating a scrubbing liquid which contains a transition metal chelate such as ion EDTA and biomass (see Buisman abs. col.2 lines 56 – 67). It would have been obvious to one having ordinary skill in the art at the time of the invention to use a known functionally equivalent mean of providing the scrubber with biomass to aid in the reduction of nitrogen oxides to molecular nitrogen.

Grierson (WO 92/17401) disclose a method of purifying a gas stream using a scrubbing liquid (reaction solution which remove the impurity in the gas) and membrane separation process wherein at least a portion of the scrubbing liquid (reaction solution) goes through a filtration step consisting of membrane filtration step such as ultrafiltration to produce a fully clarified scrubbing liquid by removing solidified component. The filtrate from the filtration step is contacted with a nanofiltration membrane leaving a non-permeate concentrate portion comprising water and ion chelate, which is recycled to the scrubber. It would have been obvious to one having ordinary skill in the art at the time of the invention to modify membrane separation process of Verbraak with the membrane separation process as taught by Grierson since, Grierson states on page 4 line 19 – 25 that such a separation process would control the build-up of undesirable compound in the scrubbing liquid and also on Page 6 line 34 –35 that the process improves the usable life of the scrubbing liquid. Furthermore, the combined reference fails to disclose that the biomass is removed from the scrubbing liquid along with the other solidified component. However, it would have been obvious to one having ordinary skill in the art at the time of the invention to remove the biomass along with other solidified component in order to prevent build-up of spent biomass in the scrubbing liquid.

Regarding claim 2, the combined reference discloses the method according to claim 1. The combined reference fails to disclose the method of claim 1 wherein the first membrane is a membrane capable of permeating compounds having a molecular weight of 1,000 Dalton. However, Grierson (WO 92/17401) disclose that it is known in

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the art for chelate to have molecular weight between about 1000 and 500,000 Daltons (see Grierson page 3 lines 33 –35). It would have been obvious to one having ordinary skill in the art at the time of the invention to have the first membrane of the combine be capable of permeating compound having molecular weight of 1,000 Dalton since it known in the art for chelate to have molecular weight of 1000 Dalton and the first membrane of the combined reference produces a filtrate containing chelate.

Regarding claim 3, the combined reference discloses the method according to claim 1 wherein the first membrane is an ultrafiltration membrane (see Grierson page 6 line 26 – 30).

Regarding claim 4, the combined reference as applied to claim 1 above discloses the method according to claim 1 wherein the gas further comprises at least one of a sulfur oxide ( $\text{SO}_x$ ), which is converted into at least one of a solidified sulfite or sulfate salt, and the scrub liquid further comprises an agent for binding with the sulfur oxide, and wherein solidified sulfite and/or sulfate salts are separated from the scrub liquid (see Verbraak page 5 lines 33 – 35, page 6 lines 33-37 and page 7 lines 10-17).

Regarding claim 5, the combined reference discloses the method according to claim 4. The combined reference fails to disclose the method of claim 4 wherein the first permeate is pre-treated before nanofiltering so as to prevent the solidification of compounds that are liable to cause scaling. However, Grierson (WO 92/17401) further

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discloses gas-purifying process where the first filtrate (first permeate) is pre-treated before nanofiltering (the first filtrate is pretreated by passing the filtrate through another filtration unit before nanofiltering) (see Grierson page 7 line 25 – page 8 line 10, page 15 lines 4 – line 8). It would have been obvious to one having ordinary skill in the art at the time of the invention to pre-treat the first permeate of the combined reference before nanofiltering as taught by Grierson since it was known in the art at the time to do so and furthermore because Grierson states at page 7 lines 34 –35 that such a step helps to remove solid fines and to provide the nanofiltering step with a fully clarified stream)

Regarding claim 7, the combined reference discloses the method according to claim 4 wherein the scrub liquid is pre-treated before filtering using the first membrane so as to prevent the solidification of compounds that are liable to cause scaling (sodium – containing compound is again added before the filtration step see Verbraak page 7 lines 10 - 15).

Regarding claim 10, the combined reference discloses the method according to claim 1 where in the conversion of the nitrogen oxide into molecular nitrogen is brought about by the biomass (see Verbraak page 2 line 38 – page 3 line 1).

Regarding claim 11, the combined reference discloses the method according to claim 1 wherein the agent for binding with the sulfur oxide comprises at least one of calcium and magnesium ions (see Verbraak page 4 lines 10 –12).



Regarding claim 12, the combined reference discloses the method according to claim 1 wherein the dissolved components of the permeate liquid comprise at least one of chloride and sulfate ions (in the method of sulfur oxide is present in the gas and when sodium aqueous hydroxide is added to the scrubbing liquid the sulfur oxide is converted to sodium sulfate which dissolves hence page 7 lines 10 -19).

Regarding claim 14, the combined reference discloses the method according to claim 1 wherein the metal ion chelate comprises an aminopolycarboxylic acid, preferably ethylene diaminetetraacetic acid (EDTA) and a transition metal ion, preferably a ferrous ion (see Verbraak page 3 lines 5 –27).

Regarding claim 15, the combined reference discloses the method according to claim 1. The combined reference fails to disclose the method of claim 1 wherein the ultrafiltration membrane is selected from polysulfone, polyethersulfone, polyvinylidene fluoride, polyacrylonitrile, or modified versions thereof, and the nanofiltration membrane is selected from asymmetric phase inversion membranes or thin film composite membranes. Grierson (WO 92/17401) further discloses that it is known in the art that membrane formed of polysulfone will generally fall into the class of ultrafiltration membrane and Grierson also discloses that it is known in the art for thin film composite membrane to be used as nanofiltration membrane (see Grierson page 17 lines 1 - 15 and page 20 lines 21 – 35). It would have been obvious to one having ordinary skill in

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the art at the time of the invention to used the polysulfone membrane as the ultrafiltration membrane and thin film composite membrane for the nanofiltration membrane since it is well known in the art to do so.

Regarding claim 16, the combined reference discloses the method according to claim 1 wherein monovalent cations (aqueous sodium hydroxide contains  $\text{Na}^+$ ) are added to the scrub liquid (see Verbraak page 7 line 10-11).

Regarding claim 17, Verbraak discloses an apparatus comprising a scrubber (1) and membrane separation unit (32) (see Verbraak page 2 line 30 –39 page 3 line 1, lines 7 –16page 5 lines 33 –39, page 7 lines 10 –16). Verbraak fails to specifically disclose that membrane separation unit (32) is characterized in that the membrane separation unit comprises, first filtration compartment (15) comprising a membrane capable of permeating the metal ion chelate, a second nanofiltration compartment, means for transporting the retentate liquid obtained in the second nanofiltration compartment to the scrubber and/or means for transporting the retentate liquid obtained in the first filtration compartment to the scrubber optionally, a first pretreatment module (30), a second pretreatment module (35) and a second nanofiltration compartment (18).

Grierson (WO 92/17401) disclose a device of purifying a gas stream comprising a scrubbing and membrane separation unit wherein the membrane separation unit comprises first filtration compartment (a first ultrafiltration unit to produce a fully clarified scrubbing liquid by removing solidified component), a second nanofiltration

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compartment, and means for transporting the retentate liquid obtained in the second nanofiltration compartment to the scrubber (the filtrate from the first filtration step is contacted with a nanofiltration membrane leaving a non-permeate concentrate portion comprising water and ion chelate, which is recycled to the scrubber). It would have been obvious to one having ordinary skill in the art at the time of the invention to modify membrane separation unit of Verbraak with the membrane separation unit as taught by Grierson since, Grierson states on page 4 lines 19 – 25 that such a separation unit would control the build-up of undesirable compound in the scrubbing liquid and also on page 6 line 34 –35 that the process improves the usable life of the scrubbing liquid. Furthermore, apparatus as disclosed by the combined reference is capable of performing the method of claim 1 as disclosed.

7. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbraak (WO00/02646) in view of Buisman et al (US 5,891,408) and Grierson (WO 92/17401) as applied to claim 1 above, and further in view of the applicant's admitted prior art.

Regarding claim 13, the combined reference discloses the method according to claim 1. The combined reference fails to disclose the method of claim 1 wherein the biomass comprises at least one of bacteria and yeast. However, it would have been obvious to one having ordinary skill in the art at the time of the invention to have the biomass of the

combined reference comprising at least one of bacteria and yeast since the applicant admits in paragraph [0003] that it was known in the art to use such biomass in a method for removing nitrogen oxide from a gas.

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Verbraak (WO00/02646) in view of Buisman et al (US 5,891,408) and Grierson (WO 92/17401) as applied to claim 1 above, and further in view of Hums et al (US 6,368,566).

Regarding claim 9, the combined reference as applied to claim 1 above discloses the method according to claim 1. However, the combined reference fails to disclose the method of claim 1 wherein the gas further comprises heavy metals. It would have been obvious to one having ordinary skill in the art at the time of the invention for the gas in the combined reference to comprise of heavy metal because it is well know in the art for gases such as flue gas that comprise nitrogen oxide to also comprise heavy metal (see Hums col. 3 lines 58 – 62).

#### ***Allowable Subject Matter***

9. Claims 6 and 8 are objected to as being dependent upon a rejected base claim (claim 5 and 7), but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

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The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 6 and 8, the method according to claim 5 and 7 wherein the first permeate/ scrub liquid is diluted with an amount of water which is at least equal to the amount of water that is removed by nanofiltering of the first permeate minus the amount of water that can be removed without precipitation of the inorganic compounds in the first permeate could not be found in the prior alone or in combination.

***Conclusion***

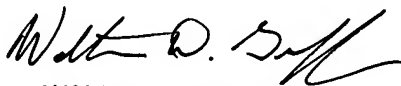
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shanta G. Doe whose telephone number is 571-270-3152. The examiner can normally be reached on Mon-Fri 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter Griffin can be reached on 571-272-1447. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Gsd

  
WALTER D. GRIFFIN  
SUPERVISORY PATENT EXAMINER